AMENDMENTS

Please amend the application as indicated.

Amendments to the Specification

In the Specification:

Please replace the paragraph beginning on page 4, line 12 with the following amended paragraph:

Figure 3A is a schematic diagram illustrating an embodiment of a charge pump.

Please insert the following new paragraph after the paragraph beginning on page 4, line 12:

Figure 3B is a schematic diagram illustrating an alternative embodiment of a charge pump.

Please replace the paragraph beginning on page 10, line 20 with the following amended paragraph:

Figure 3A is a schematic diagram illustrating another embodiment of a charge pump 300. The charge pump 300 may be used in low voltage applications. To improve the power supply noise rejection (PSNR) from the power supply noise, the supply voltage (VDD) 350 to the charge pump 300 is less than conventional charge pumps. For example, VDD may be between 3.3V and 1.0V. In one embodiment, the supply voltage may be approximately 2.2V to 1.8V.

Please replace the paragraph beginning on page 12, line 21 with the following amended paragraph:

The voltage divider circuit provides a biasing voltage to the gates of the complementary transistors 318 and 324. The biasing voltage (Vb) may be approximately half the supply voltage, however, other voltages may also be used. The voltage divider circuit may include the several resistors 332 – 346. The voltage divider circuit illustrated in Figure 3A shows four resistors 332, 334, 336, and 338 between the supply voltage and

the biasing voltage and another four resistors 340, 342, 344, and 336 between the biasing voltage and ground. The resistors 332 - 346 may be interdigitized to conserve space. For example, the resistor 332 may be interdigitized with the resistor 340, the resistor 334 may be interdigitized with the resistor 342, the resistor 336 may be interdigitized with the resistor 344, and the resistor 338 may be interdigitized with the resistor 346. The resistors that are interdigitized preferably have equal resistance. Two or more resistors may be used for each half of the resistor chain to provide for better resistance matching. The resistors 332, 334, 336, and 338 may be substantially balanced with the resistors 340, 342, 344, and 346, such that the voltage between resistors 338 and 340 is approximately half the supply voltage. In an embodiment, the voltage divider circuit can include multiple voltage dividers (as shown with respect to FIG. 3B). Such voltage dividers can provide multiple reference voltages. The reference voltages may be between the minimum and maximum voltage levels (voltage range) of the input signals. A reference voltage of substantially half the range of the input signal is preferred.

Please replace the paragraph beginning on page 14, line 1 with the following amended paragraph:

The embodiment of the RC filter 360 illustrated in Figure 3A shows the source node of the transistor 362 connected with the input signal of the RC filter 360. The gate of transistor 362 is connected with ground. In this configuration, the transistor 362 behaves substantially as a resistor. The drain of the transistor 362 is connected with the gate of the transistor 364 and the output node 308 (Vcn). The source and the drain of the transistor 364 are connected with ground. In this configuration, the transistor 364 behaves substantially as a capacitor. The transistors 362 and 364 form a circuit substantially equivalent to an RC circuit. Transistors may be used instead of resistors and capacitors to save space.

Please replace the paragraph beginning on page 15, line 18 with the following amended paragraph:

The charge pump 300 (Figure 3A) and the voltage to current converter 400 (Figure 4) may be used in a phase lock loop where a phase and frequency detector receives a reference signal and frequency feedback signal. The phase and frequency detector generates control signals, e.g. NUP and NDW, and transmits the control signals to the charge pump 300. The charge pump 300 generates differential output signals, e.g. Vcp and Vcn. A loop filter may be connected with the Vcp signal or both signals. The Vcp and Vcn signals are received by the voltage to current converter 400. The converter 400 generates an output signal Iout. A current controlled oscillator ("ICO") receives Iout and generates an output frequency feedback signal, Fvco. The output frequency feedback signal may be received by an optional frequency divider or may be received directly by the phase and frequency detector as VCOin. Other circuits may also utilize the charge pump 300 or the voltage to current converter 400. The voltage to current converter 400 and the current controlled oscillator in combination may be referred to as a voltage controlled oscillator.